# JOURNAL OF ELECTRICITY

## POWER AND GAS

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SAN FRANCISCO'S NEW AUDITORIUM.

INSIDE WIRING METHODS.
BY JOHN CARRELL.

INDUSTRIAL USES OF FUEL OIL.
BY F. B. DUNN.

INDUCTIVE INTERFERENCE DISCUSSION.



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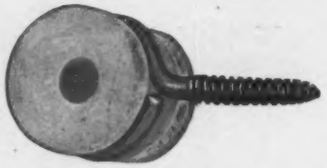

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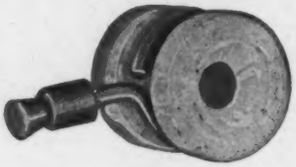

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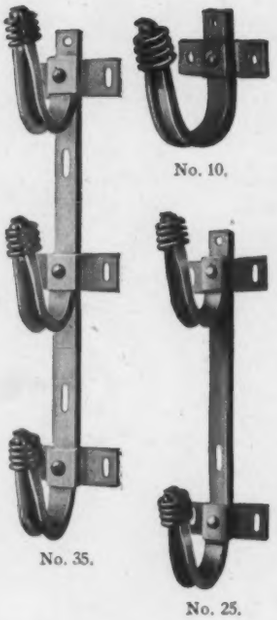

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THE PEIRCE LINE is all high grade carbon steel, hot dip galvanized; quickly put in place by the lineman and labor saving in many other ways.

Mr. Central Station Manager, have you seen the new catalogue on this line of goods; those pictured are only a few from the line. You ought to have one handy. There are a lot of good suggestions that will tend to help you keep down costs for the coming season's work. Get one by dropping a line to

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JOURNAL OF ELECTRICITY
POWER AND GAS
Devoted to the Conversion, Transmission and Distribution of Energy

VOLUME XXXIV | SAN FRANCISCO, JANUARY 16, 1915 | NUMBER 3

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# SAN FRANCISCO'S NEW AUDITORIUM

San Francisco's new municipal auditorium in which the great conventions will meet during 1915, like the great Panama-Pacific International Exposition, is ready ahead of time, having been dedicated by an opening ball on the night of January 9, 1915. The building covers a ground area of nearly one hundred thousand square feet at the new Civic Center. It was built by the Exposition company on city-given land. It cost nearly $2,000,000 and will stand as a lasting monument to the Exposition.

On either side of the main hall is a banquet hall 56 ft. 3 in. by 136 ft. 6 in., extending to the top of the second floor level. Above the banquet halls, on the third and fourth floors, are smaller halls or exhibition rooms, committee rooms, reception rooms, cloak rooms and spaces for chair storage. The basement is used for machinery rooms, chair storage, the stabling of horses during a show and is fitted with a large kitchen for use with banquets, clothes lockers for attendants and the general toilets.

Exterior View of New Municipal Auditorium at San Francisco.

The main facade, on Grove street between Polk and Larkin streets, is constructed of California granite. It fronts a plaza bordered by the other great buildings of the civic center. The building has a length of about 400 ft. and a width of 268 ft. There are four stories and a basement, arranged to permit using the building for the greatest variety of purposes.

The main auditorium is in the shape of a maltese cross extending through the entire height of the building and is crowned with an octagonal lantern, 40 ft. in diameter with its base 95 ft. above the floor. The roof is octagonal in shape, is supported on 8 columns and has a clear span of 190 ft. On three sides, the balconies extend a distance of 32 ft, outwardly thus making the maximum width 254 ft. The hall has an unobstructed level floor area of 38,380 sq. ft., giving seating facilities for 5000 people, while the gallery will accommodate 5000 more.

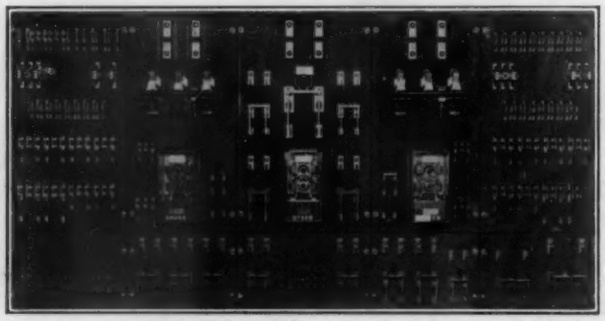
## Lighting.

The general lighting scheme has been laid out with the idea of providing a generous amount of illumination in every space and so subdividing the circuits as to obtain three degrees of illumination.

The entire current supply is distributed from the main switchboard in the basement and from that point, feeders are continued to the various distributing panels for light and power.

The lighting of the main auditorium is derived principally from forty-eight 500 watt tungsten lamps mounted in porcelain enameled reflectors set in openings through the under side of the perimeter of the roof lantern, forming an octagon 40 ft. in diameter. An auxiliary distributing panel is located in the lantern and from there the various circuits are continued to the outlets; these circuits are divided into six groups, each group feeding one light outlet in each

side of the octagon. The groups are controlled by switches on the main auditorium board in the switchboard room at the front end of the main entrances, first floor; auxiliary lighting, over and under the balconies, is provided by drop fixtures in the former and hemispheres in the latter, all circuits being controlled from the auditorium board above mentioned. Provision is made for the future control of all the circuits, in groups, from the organ loft or a temporary stage, both of which are at the rear end of the auditorium,



Front View of Five Panel Switchboard.

by means of remote control switches. A large feeder has also been continued to the stage location for future stage or other temporary lighting.

Each banquet hall is controlled from a local panel board with circuits so divided as to give any desired degree of illumination. A motion picture or stereopticon room is located at the second floor level and to the front of each banquet room, with provision for a duplicate set of equipment and control of the banquet room lighting through remote control switches on the local panel boards.

Corridor and small hall lighting is controlled from local panel boards on the respective floors. All exit and emergency light feeders are controlled from the main switchboard through remote control switches operated from the master board in the main ticket office and are also controlled locally, at each floor panel board.

Semi-direct lighting is used in all small halls, reception and committee rooms while the lighting of the main auditorium, corridors, toilets and basement is direct.

The large size of the principal corridors renders them available for use as social gathering places and, during fairs or other entertainments, they may be used for the erection of booths or stands and with this idea in view an unusual amount of illumination has been provided in these spaces.

Referring again to the main auditorium, a cross section through the center line shows that the area to be lighted is practically in the form of the section of a sphere so that the method of lighting by means of centrally placed units 95 ft. above the floor works out ideally as regards uniformity of illumination. It was necessary to place units above the rear balconies and under the front balconies in order to overcome shadow effects and the falling off of the light distribution from the type of reflecting units used in the main outlets.

Above the central units and following the outline of the lantern, is a runway from which any of the reflectors can be easily reached and lifted out of the springs in which they rest, for cleaning or renewal of globes. Each reflector is connected to a Hubbell receptacle, located near it on the side of the lantern, by means of a short, flexible cord so that the entire unit can be lifted up to the top of the runway.

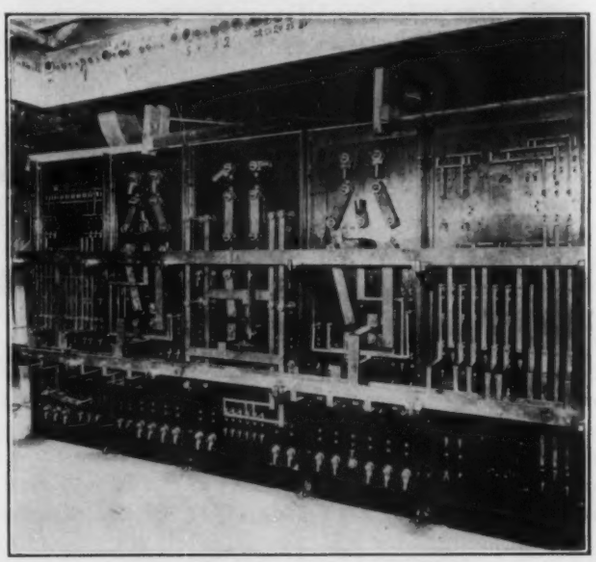
Exterior decoration has been limited to that outlining the underside of the marquise and illuminating the three main arches in the facade. These main arches extend from the first to the fourth floors and are fitted with double glass sash with an intervening space of about two feet. Outlets are spaced every nine inches on the vertical frames of the outer sash and are fitted with 5 watt, all frosted, tungsten lamps operated from the secondaries of special transformers which are located in metal cabinets in the spaces between the inner and outer windows. The lamps are wired on the three wire system and are controlled from the main ticket office through remote control switches as are the lights under the marquise. With the inner faces of the window glass frosted, an even illumination is distributed over the entire glass surface and, when viewed from the front, the interior corridor lighting and shadows from the floors crossing the arches are smoothed out and practically eliminated.

The lighting scheme as laid out for the Civic Center Plaza, toward which the Auditorium faces, will provide sufficient illumination to bring out all the architectural features of the building and for that reason, all decorative lighting was omitted from the exterior.

Current is taken from the underground mains of the Pacific Gas & Electric Company, and, as previously mentioned, is distributed from the main switchboard in the basement, where are also the meters and main circuit breakers as well as all switches and protective devices for the elevator, ventilating and pumping motors.

### Switchboard.

The main switchboard in the basement cares for three services, two supplying the lighting and ventilating system, the third supplying power for the freight and passenger elevators only. Two remote

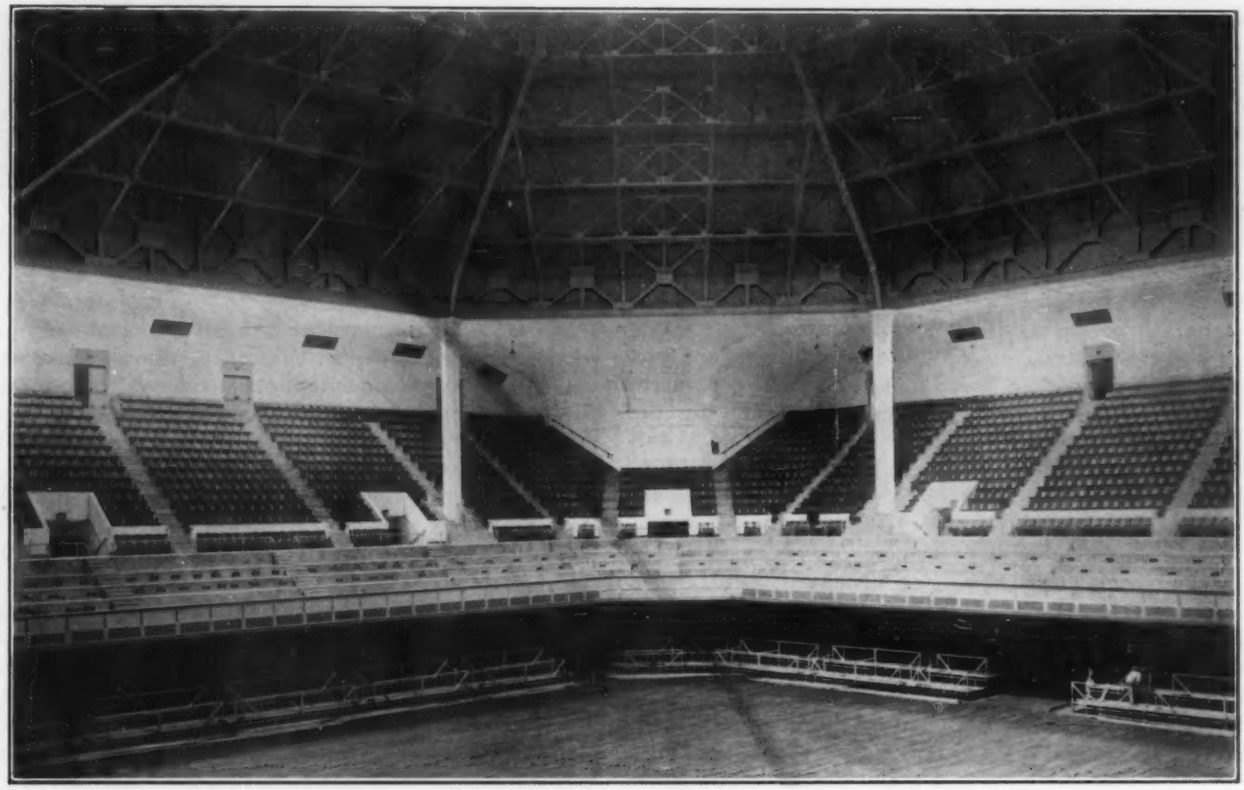


Rear View of Main Switchboard.

control service switches of the circuit breaker type afford instantaneous disconnecting of the lighting and ventilating systems, should emergency require, whereas elevator power is controlled by a manually operated knife switch. The system employed in this building is 220 volts direct current for ventilating and elevators, and 125-250 volts direct current for general lighting. Both sides of each service are brought through the meters, and in case of the lighting, are multiplied together to the same main bus bars on the house side, thus permitting the use of only one service when running on a light load.

triple arched pattern, on the Grove street side are controlled by panel boards located between the double windows of the exterior wall. In each of these cabinets is also located one 1-kilowatt transformer 220 volt primary, and 12-24 volt, 3-wire secondary to feed these special features. The main switchboard and all the panel boards throughout the building were made by the Drendell Electric & Manufacturing Company of San Francisco.

In addition to illumination requirements electric current is also supplied for the operation of four 50 h.p. Van Emon passenger elevators serving the third



Interior View of Auditorium.

Auxiliary remote control switches are provided on this board for the control of the auditorium exit lights and marquise, and the front arched window lights on the Grove street side of the building thus permitting operation of these circuits from the first floor.

The various circuits throughout the building terminate in a pull can directly above the main switchboard and thence are brought down vertically to their respective switches.

The switchboard itself consists of five panels of 2 in. black Pennsylvania slate, together with their respective sub-bases, and mounted upon an angle iron frame work, with channel supports both top and bottom. The main bus bars as shown in the illustration are supported upon cast iron brackets insulated with slate basis and with the minor buses bolted thereto, by means of right angled offset copper straps.

The circuits controlling the ceiling, balcony, and under balcony lights are controlled by auxiliary remote control switches, mounted on a separate auditorium switchboard. The three windows of the

and fourth floors, two electric freight elevators, two hydro-pneumatic freight elevators, 18 ventilating fans, three vacuum pumps and circulating pumps for air washers and sump pumping.

The total current consumption for power is 3000 amperes at 220 volts, and for lighting 1382 amperes at 220 volts. Separate feeders are run to each fan room on the roof, to each elevator motor and to the main machinery rooms in the basement.

### Heating and Ventilating.

The ventilating system consists of two identical sets placed in the basement on the east and west side of the building, each set serving the needs of its respective side. Each of these sets is equipped with motor-driven supply and exhaust fans having a combined capacity for supply and exhaust of 790,300 cu. ft. per minute.

In each fan room a 145,000 cu. ft. per minute fan draws fresh air from the roof through an 8 by 18 ft. air shaft and forces it through outlets in the balcony railing of the main hall and under the seats in the balcony.

Each of these fans is driven by a 75 h.p. d.c. motor. There are also four exhaust fans, two 75,000 cu. ft. per minute fans driven by 35 h.p. motors drawing the air through floor registers into the basement and two 70,000 cu. ft. per minute fans driven by 20 h.p. motors on the roof discharging from registers in the balcony ceiling.

Each of the smaller east and west halls are supplied with fresh air through apertures above the door by 33,000 cu. ft. per minute fans operated by 15 h.p. motors. Two sets of 30,000 cu. ft. per minute fans with 15 h.p. motors exhaust the air through registers near the floor. These rooms are heated direct from radiators concealed in pockets under the windows.

The first floor corridors are supplied with fresh air from two 15,400 cu. ft. per minute fans equipped with 7½ h.p. motors. A 10,000 cu. ft. per minute fan driven by a 15 h.p. motor supplies fresh air to the kitchen in the basement and a similar fan discharges to the roof. The lavatory exhaust is taken care of by four small fans.

The exhaust air is discharged into two concrete tunnels 6 by 10½ ft. leading to 7 by 19 ft. exhaust risers fitted with rolling doors on top.

All incoming fresh air is passed through air washers and the heater coils of a Webster heating system, steam being supplied from a separate boiler plant in the Civic Center. All the fans were made by the American Blower Company and are driven by Westinghouse motors with Westinghouse control. Hunter & Hudson of San Francisco acted as engineers for the heating and ventilating system.

A complete telephone system of wiring has been installed connecting all the rooms, halls, etc., with a central station in the building; numerous public stations are located throughout the corridors for the use of visitors and a telegraph office is located in the first floor corridor with branch connections to various substations for the use of the press or the general public.

Each of the three main entrances is fitted with an electric carriage call system with electric annunciators of the flash light type located over the marquise and showing signals which can be seen from within a wide radius.

A manager's call bell system, with push button in the main office, connects with bells distributed over the entire building so that he may be called from any part.

The entire electrical installation was designed and supervised by W. W. Hanscom, consulting electrical engineer at San Francisco, the F. E. Newbery Electric Company having the contract.

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**The output of a dry cell** is between 16 and 20 watthours, according to tests in the engineering laboratories of the University of Wisconsin. At a retail price of 25 cents per cell, this is at the rate of from $16.60 to $12.50 per kilowatt-hour.

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**A lighting contract clause** which forbids a party from using any other form of artificial lighting during the term of the contract is not enforceable, but does not void the whole contract. This point was brought out in a lawsuit over the contracts of the Washington Water Power Company of Spokane.

## PLANS OF NATIONAL JOINT COMMITTEE ON LINE CONSTRUCTION.

For the purpose of completing its organization and laying out its working program the National Joint Committee on Overhead and Underground Line Construction held a meeting at the headquarters of the American Institute of Electrical Engineers on December 16th. According to present plans this committee will prepare specifications or suggested practices or perhaps recommend modifications of existing regulations relating to the following subjects:

(1) Underground and undergrade crossings.

(2) Crossings of electric wires over electric railway tracks.

(3) Crossings of trolley contact wires.

(4) Overhead crossings of wires or cables of telegraph, telephone, signal and other circuits of similar character over steam railroad rights of way, track, or lines of wire of the same classes.

(5) Overhead crossings of electric light and power lines.

(6) Parallel lines.

Specifications covering subject No. 4 already prepared by an earlier joint committee representing various interests are now being considered for adoption by the National Joint Committee. Subject No. 5 has been covered by the present standard specifications, the edition adopted and published by the American Electric Railway Engineering Association, being the latest revision. The other subjects are new and specifications relating thereto will have to be prepared by the committee which desires to enlist the co-operation of all persons and associations intersted in any subject pertaining to line construction, with the object of preventing duplication of work and insuring uniformity in the specifications adopted by the various associations, thereby avoiding all unnecessary conflicts, and it is the desire of the committee to be looked upon more or less as, the court of last resort in the formulation and interpretations of specifications and as such would like to receive the hearty support of all interests concerned.

The National Joint Committee is made up of official delegates and alternates from the following organizations:

**American Railway Association.**
**American Railway Engineering Association.**
**Railway Signal Association.**
**Association of Railway Telegraph Superintendents.**
**National Electric Light Association.**
**American Electric Railway Engineering Association.**
**American Institute of Electrical Engineers.**
**American Electric Railway Association.**
**American Telephone and Telegraph Company,**
**United States Bureau of Standards.**
**Independent Telephone Association of America.**
**Western Union Telegraph Company.**
**Postal Telegraph Company.**

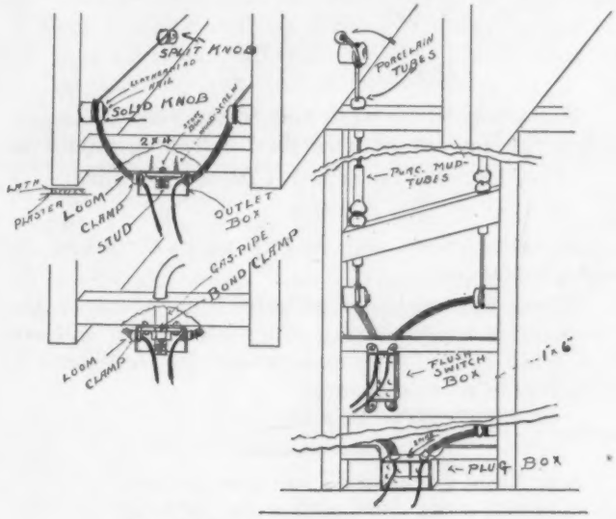
Mr. Farley Osgood, Newark, N. J., is chairman, and Mr. G. W. Palmer Jr., Boston, is vice-chairman of the committee. The secretary is Mr. R. D. Coombs, 30 Church street, New York, and Mr. W. H. Feller, 759 Broad street, Newark, N. J., is assistant secretary.

# INSIDE WIRING METHODS

By JOHN CARRELL

## Knob and Tube Details.

**In knob and tube work** the wire used is of copper, not smaller than No. 14 B. & S. gauge, with a covering of rubber and an outer braid designed to withstand abrasion. This covering, while possessing high insulating qualities, is of inflammable character. The




Details for Knob and Tube Wiring.

wires are kept 1 in. from surfaces wired over, are spaced 5 in. apart and supported at intervals not exceeding 4½ ft. by means of porcelain insulators.

Solid knobs are used to secure wires at turns or ends of runs and split knobs, or cleats which grip the wire at all other points. These knobs are fastened in place with screws or nails equipped with leatherheads.

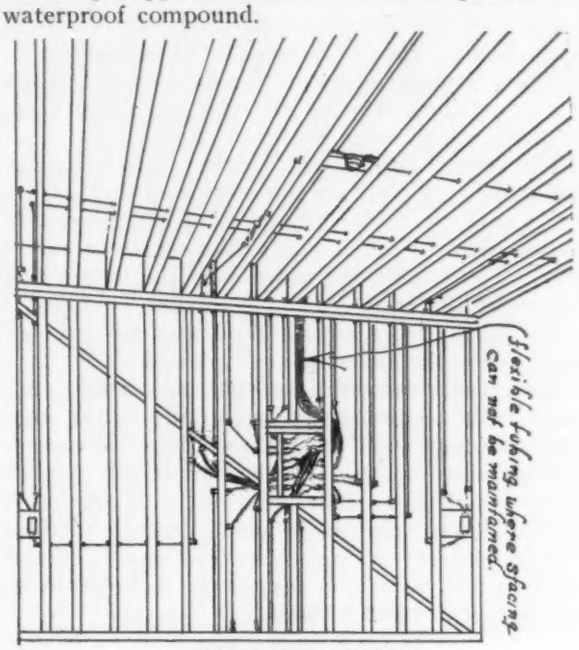
Porcelain tubes are used to separate wires from materials passed through. They are also used as mud tubes, or to enclose wires directly above cross timbers in plastered partitions, and as cross-over tubes, or for protection where liability exists for contact with metallic piping, other wires or conducting material.

Each point in the wiring system at which current is to be issued or controlled is called an outlet. To comply with all the recommendations of the code an outlet box must be provided for each outlet. These are secured in place in different ways, depending on location and use.

**Flexible tubing** is used to enclose wires at all outlets where a 5 in. spacing cannot be maintained and where it is impracticable to install all of a circuit by means of porcelain knobs and tubes. When so used each wire must be separately enclosed, the lengths to be continuous between porcelain supports, from porcelain support to outlet or from outlet to outlet.

Flexible tubing is especially designed to withstand abrasion, has a smooth interior surface to permit easy insertion of wire and is constructed of or impregnated with material which serves as both a fire resistant and moisture repellant. It is not to be installed in damp places or where voltage exceeds 300. Where entering metal walls of outlet boxes, cabinets, etc., it is to be secured thereto with clamps.

**Splices** or taps made in or to wires must be mechanically secure and are soldered to prevent corrosion. The splices are insulated with layers of rubber and friction tape, applied in order named, and painted with a waterproof compound.




Flexible Tubing Installation.

The electrical arrangement of a knob and tube job may usually be divided into branch circuits, cut-out cabinets, feeder circuits, meter board and service circuits.

**Cut-out cabinets** are constructed by placing cross pieces at right angles between studs so as to form four sides of an enclosure. One of the remaining sides is filled in with boards and the other side left for a door. Later, when the plaster work is completed, the en-

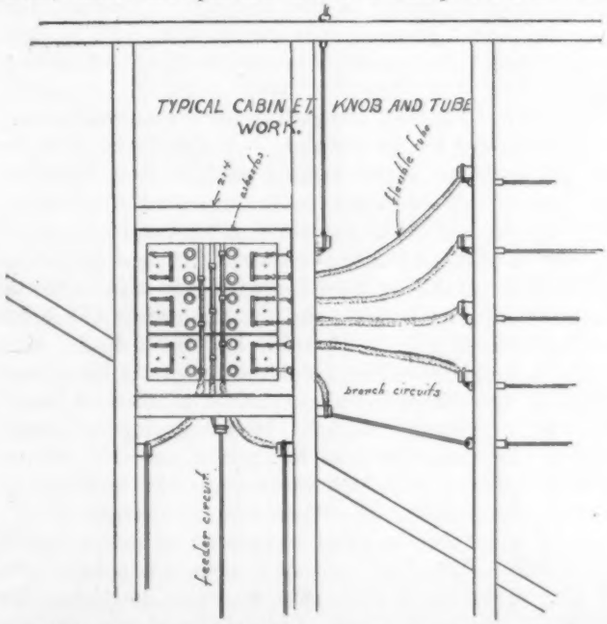



Illustration of Typical Cabinet for Knob and Tube Work.

closure will be lined with asbestos, a door and trim, also lined with asbestos, will be mounted and the required coutouts placed therein.

**The meter board** will be located near the street door of tradesmen's entrance or, if no such entrance exists, a meter cabinet lined with asbestos, will be built in the side of structure so as to be accessible for meter reading without bothering tenants. The meter board is the distributing center to which the feeder circuits from the respective cabinets connect to the service circuit. For small installations, where the cost of running branch circuits to this location is less than that for installing cabinets and feeders, it will be the only distributing center in the building.

**The service circuit** will usually extend from the meter board to a point on the outside of the building, from 15 to 20 ft. above ground level and nearest the proposed place of connection to the source of current supply. The established practice in the larger cities is to enclose the service wires in conduit, equipped on the outer end with a service hood and the inner end extending into the meter cabinet or board.

**A main service switch and cut-out,** located as near as practicable to point of service entrance and arranged so that the fuses will protect and switch disconnect all of the wires which enter the building, is required for each installation. The only exception to this requirement is for fuses in grounded neutrals of three-wire direct current or single phase systems. The service switch and cut-out is very often included in the equipment of the meter board.

### Figuring Small Jobs.

Figuring work at so much per outlet is a habit to which many contractors are addicted. The chief reason for this is that the pioneers figured that way. There is also an economic reason: Prospective purchasers desire to apportion quantities bought according to cost thereof. To do this they must know prices in quantity—units which can be understood. Unfortunately for the contractor the only part of wiring that people can see are the outlets. Many architects are little better informed in this respect. However, this may be, the "so much per outlet method" is erroneous except for small flats or dwellings of typical class.

Another method, somewhat more systematic, may be understood by an example. A flat 25 ft. wide by 60 ft. long has eight ceiling outlets, five brackets, six single pole switches, two plugs and four 3-way switches, or a total of twenty-five outlets to be wired to; 800 ft. of No. 14 wire is required for the job. About half this wire will be used for wiring in sidewalls and for allowances at outlets, and the remaining 400 ft. for wiring in ceilings. If this flat had been 40 ft. wide by 75 ft. long the wiring in sidewalls would have been precisely the same, but about 150 ft. more wire would have been used in ceilings. It is therefore apparent that a way must be used to approximate the wiring cost in ceilings in which the size of the budliing as well as the number of outlets can be considered.

All items are classified and priced to include entire installation cost, i. e., ceiling outlets to include cost of box, accessories, allowance for wire and labor for setting; side wall outlets to include above, and, in addition, the cost of wiring in wall; cut-out cabinets and meter boards to include installation cost based on number of circuits and including wiring in walls. These items will not vary greatly for ordinary knob and tube jobs. If the flat described is taken as the average, then the average horizontal dimension will be $25 \times 60 \div 2 = 42.5$ ft.

$$\frac{\text{wire in ceiling}}{\text{Average dimension} \times \text{number of outlets}} = \text{constant or}$$

$$\frac{400}{42.5 \times 25} = .3765$$

For a job 50 ft. wide and 80 ft. long having 35 outlets the amount of wire used in ceiling would be

Ave. Diam. $\times$ Outlets $\times$ Constant = Wire

$65 \times 35 \times .3765 = 850$ ft.

Service circuits and feeders vary according to wiring distances.

When figuring jobs entirely from averages the contractor is liable to take some jobs which will not show a fair profit. The man behind the roto-meter is not so liable to this chance.

(To be continued.)

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**A daylight glass** which will give the effect of average daylight when used with a gas or tungsten light has been developed by Mr. E. J. Brady and is described in the December, 1914, Transactions of the Illuminating Engineering Society. It not only gives the same intensity as daylight, but also the same color values.

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**An electric furnace with crude oil** as a reducing agent for smelting iron ores has not yet been successfully developed. As the result of a preliminary investigation conducted by the U. S. Bureau of Mines as to the possibility of using crude oil as a reducing agent it seems as if it is necessary to first convert the oil into a fixed gas and then introduce this into the crucible of an electric furnace, thus pre-heating the gas so that it will effectively reduce the iron oxides as it passes up the shaft of the furnace. The hydrogen and carbon of the oil will reduce iron oxides, but the problem of bringing the oil and ore together at a proper temperature has not been solved.

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**The latent heat of ice,** or conversely the amount of heat that must be removed from unit mass of water at 32 degrees F. to freeze it to ice at that temperature, has been definitely determined by the U. S. Bureau of Standards to be 143.33 B.t.u. per pound mass or 143.5 B.t.u. per pound weighed in air against brass or iron weights.

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**Melting points** of refractory elements and oxides have been reported by the U. S. Bureau of Standards as follows:

| | | |
|---|---|---|
| Ni | 1452° C. | ± 3 |
| Co | 1478° | ± 5 |
| Fe | 1530° | ± 5 |
| Mn | 1260° | ± 20 |
| Cr | 1520° C. to Fe? | |
| Va | 1720° | ± 30 |
| Ti | 1795° | ± 15 |
| $Cr_2O_3$ | 1990° C. | |
| $Al_2O_3$ | 2050° | |
| CaO | 2572° C. | |
| MgO | 2800° | |

# INDUSTRIAL USES OF FUEL OIL

BY F. B. DUNN.

(Continued.)

### The Use of Oil in the Manufacture of Cement.

The term "cement," as used in building operations, signifies a compound of lime and other substances that hardens under water or in contact with water. It is a mixture of lime, or lime and magnesia, with clay, or silicia, or both. It differs from common quicklime, in that it does not slake, expand or crumble, nor give off heat when wet, but chemically combines with part of the water to form a firm, solid rock.

Portland cement may be defined as a compound consisting chiefly of silicates and aluminates of lime, produced by the calcination to incipient vitrification of a mechanical mixture of calcareous and argillaceous materials. The clinker thus produced is subsequently ground to a powder. The exact chemical composition of Portland cement varies considerably, its principal constituents being lime, silicia, aluminum, and oxide of iron, mixed roughly in the following proportions: lime, 60 to 67 per cent; silicia, 20 to 27 per cent; alumina 6 to 10 per cent; iron oxide 3 to 5 per cent. These four constituents, as a rule amount to about 96 per cent; the remainder consists of small quantities of sulphuric anhydride, magnesia, and alkalies.

There are two general methods of preparing and mixing the raw materials. One is known as the wet process, and the other as the dry or semi-wet process. The dry process is generally used because it is more economical. To illustrate this economy, the records of two factories, located within two miles of each other, are given in the following report:

| | Dry Process. | Wet Process. |
|---|---|---|
| Duration of test..... | 24 hours | 24 hours |
| Type of burner used..... | Inside mixer | Inside mixer |
| Atomizing agent..... | Steam | High pressure air |
| Pressure of agent at burner | 90 pounds | 80 pounds |
| Pressure of oil at burner.. | 40 pounds | 60 pounds |
| Temp. of oil at burner.... | 110° F. | 100° F. |
| Cement in metric tons..... | 43 tons | 31 tons |
| Equiv. in bbl. of 380 lb..... | 240 bbl. | 180 bbl. |
| Oil used per ton..... | 58 gals. | 70 gals. |
| Equivalent oil used per bbl. | 10 gals. | 12 gals. |

A rotary kiln is used almost exclusively in the manufacture of cement and recent tests have proven large, long kilns of this type to be the most efficient. (See Fig. 52.) The clay is treated in a small rotary kiln or dryer. The oil required to dry one ton of clay varies from five to six gallons per ton, depending upon the moisture of the clay. After having been dried, the clay is ready for the powder mill, and from there it is conveyed to the top of the roasting kiln, where it is mixed with the necessary amount of lime rock, which has also been reduced to a powder. The main rotary kilns are steel cylinders varying from 6 to 10 ft. in diameter and from 60 to 100 ft. in length. They are set on rollers, at a slope of about ½ to ¾ in. to the foot, and lined with resistant fire-brick, to withstand the great heat to which the inner surface is subjected. When operating, the cylinder slowly revolves upon the roller by means of a train of gears; this motion, in connection with the inclination of the cylinder, causes the cement mixture, which is fed into the kiln at the upper end, to move slowly to the lower end of the cylinder where it discharges into a clinker pit. As the raw material slowly works down into the interior of the kiln, the heat generated from the burners first drives off the water and the carbon dioxide from the mixture and then causes the lime, silicia, alumina, and iron to combine chemically and form a partially fused mixture known as "cement clinker." The operation during this period is closely watched by the operator. The rate of feeding the raw material is regulated by the speed which the cylinder revolves. The temperature of the kiln is regulated by the appearance of the clinker.

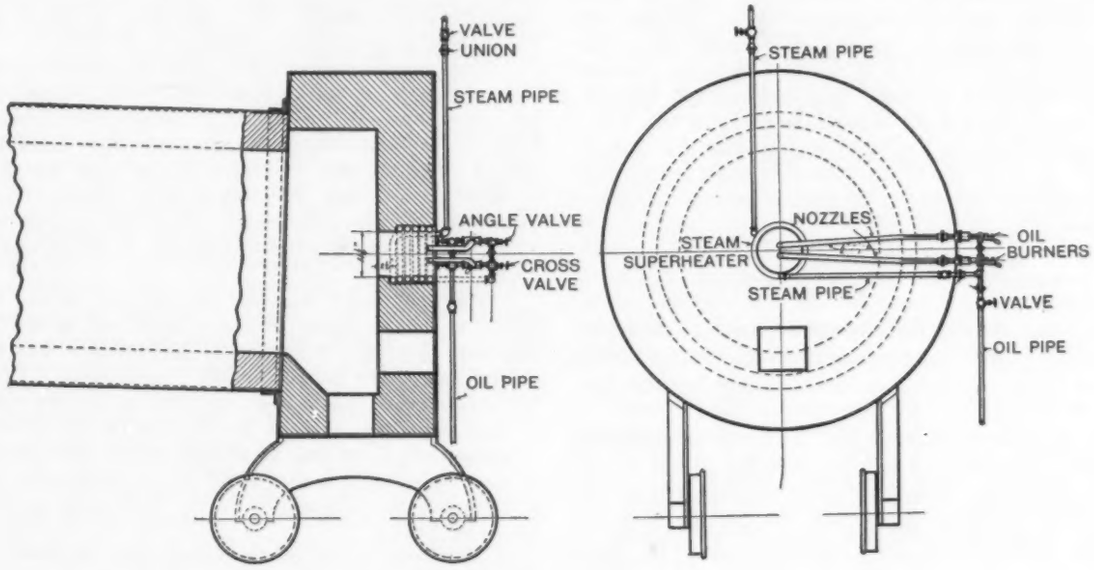


Fig. 52. Rotary Cement Kiln.

The physical and chemical changes which occur within the kiln are divided into two stages. During the first, the water and carbon dioxide is driven off, the temperature of the kiln averaging about 1800 de-

grees F. During the second stage a temperature of 2800 degrees F. is maintained, and the burnt mass is thoroughly fused. The greatest care must be exercised by the operator during this period, for if the clinker is burned too much or too little, the value of the cement will be greatly reduced. After fusion is complete, the clinker is cooled and passed to the ball and tube mills where it is ground into a fine powder.

Different cement manufacturers have widely different views on the method of firing kilns. Some recommend an intense, concentrated heat as the clinkering or fusing point, claiming that the calcining is effectively carried out by the lower temperatures of the spent gases. Others require a long, sweeping flame, extending back many feet into the kiln, claiming that they get a much more perfectly burnt clinker by this method. It is possible that peculiar characteristics

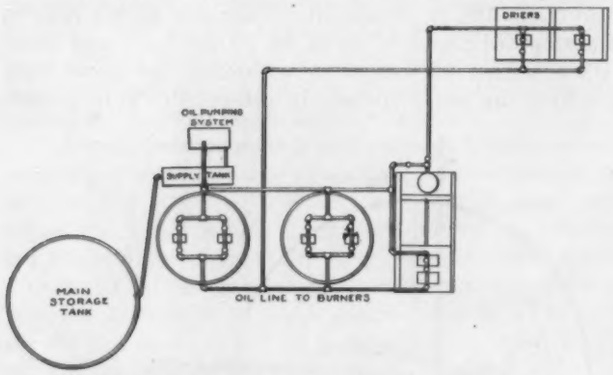


Fig. 53. General Arrangement of Storage and Piping for Fuel Oil in Cement Plant.

of the raw materials make the latter method desirable in some cases; but in the opinion of the writer, much more economical results can be obtained by the first method.

Some manufacturers claim to be able to make cement with from 8½ to 9½ gal. of oil per bbl. of cement. It is difficult to verify these statements, as the utmost secrecy is maintained in all details of operation. Frequently, however, errors can be found in their method of calculating the exact amount of oil used. Some take measurements from faulty meter readings, while others do not allow for the amount of oil required to produce the atomizing agent. A careful reading of the report reproduced below will show that the average amount of oil required per bbl. of cement lies between 10 and 12 gallons.

Various types of burners are used in cement kilns. Some use the steam atomizing type, some the high pressure air type, and some the low pressure air type. The last type has proven so much more economical than the others that many plants throughout the country have converted from steam or high pressure air burners to low pressure burners. Fig 53 shows a complete fuel oil installation at a cement plant.

**Report From Portland Cement Plant in California.**

| | |
|---|---|
| Duration of test | 24 hours |
| Type of burner used | Steam |
| Pressure of steam at burner | 80 lb. |
| Pressure of oil at burner | 45 lb. |
| Temperature of oil at burner | 110° F. |
| Estimated weight of clinker burnt | 71,060 lb. |
| Estimated bbl. of cement | 187 bbl. |
| Barrels of oil consumed at kiln | 40.98 bbl. |
| Gallons of oil used in dryer | 67.8 gal. |
| Oil used to furnish steam for atomizer | 90 gal. |
| Total oil used per bbl. of cement | 10 gal. |

[To be continued.]

## INDUCTIVE INTERFERENCE.

*(Here is presented the stenographic report of the discussion on the Report of the Committee on Inductive Interference to the Railroad Commission of California before the San Francisco Section of the American Institute of Electrical Engineers.—The Editor.)*

**C. J. Wilson:** I am sure the report of the Inductive Interference Committee, and the endorsement of the railroad commission in their general order No. 39, have set a precedent as affecting the operation of power companies and communication companies. There is a great deal in this report which is a fit subject for discussion, but I think our time is so limited that we can only enter into it in a superficial way. Mr. Babcock will open the discussion.

**A. H. Babcock:** There are two aspects of this report, that is to say, it can be regarded from radically different standpoints: (1) the technical aspect, concerning which Mr. Ferris has spoken at some length and the report at greater length; (2) The equities involved—the effect on the relations between transmission companies and communication companies; and the effect on both as regards existing and future construction.

There has been a very great amount of misunderstanding of the report, produced I think chiefly by reading it through colored glasses. The individual tendency, the individual bent of mind has something to do with it.

It should be remembered that the report was signed unanimously by a board consisting of five representatives of the power interests, five of the communication interests, four from the railroad commission, and one from the railroad interests. The railroad, by reason of the work that it does, is on both sides of the fence—it is both a communication interest and a power interest. It purchases and transmits power, and it communicates, both by telegraph and by telephone.

Now this report was not entered into in any spirit of levity, or in any desire to compromise any of the interests that were involved. It has for its basis, first, a very thorough, careful and above all a scientific investigation. I think the best evidence of this is the fact that one of the power men on this committee gave up his circuits to the investigation; he opened the doors wide to everything the committee wanted to do. He went into this thing in the spirit of a scientific investigator to develop the truth regardless of whom or where it hit.

On the other hand, the communication interests possibly were suffering from many years of oppression, from many years of interference with their circuits. One has only to go back over the history of the art of telephony to recall the fact that since the inception of the art it has been pushed from pillar to post to maintain its communication. It started out first with a grounded circuit. The street railways in the beginning speedily put that out of business. It next developed a common return. Instead of the earth the return was insulated. That also was put out of business by the encroachment of the power circuits. It developed other means for getting away from the difficulties; and as fast as a development was made in the art of telephony so did the power men come in and push it off into the corner. What wonder then that when things had reached an impasse there came the real struggle, not in court—it started unquestionably before a body of public regulation, but was taken out of the hands of the body at once by its own act, and put into the hands of men who investigated it from the thoroughly scientific standpoint. Now I don't know where you could get together a body of men—and I speak advisedly because I have attended practically every meeting of that committee—I don't know where you could find a body of men who more earnestly endeavored to develop the facts and to bring them out, regardless of whom or where they hit. As a member of that committee I resent any imputa-

tion of domination by the telephone company. There were interests there represented quite as large as any telephone interests, and quite as important as any telephone interests; and the struggle that went on was out in the open; it was give and take; and, more than that, it was shoulder to shoulder. Although we fought in the meetings, and argued points with the utmost endeavor to carry them, once the point was settled that was the end of it. We made our report as the best we could turn out. It was handed in to the railroad commission; and those gentlemen in their wisdom saw fit to add two rules, both of which in committee had been the subjects of a great deal of discussion—Rules 6 and 7.

Rule 7 has not created so much discussion as rule 6, viz: the applicability to past and future construction. This rule has been hopelessly misinterpreted by the power interests; it has been taken as a direct slap in the face. One man went so far as to say that the presentation of a report with such a rule back of it was an insult to the Institute, and there was considerable hard feeling displayed in the discussion thereof. But some of us who had the interest of the main question at heart, viz., to bring about a common understanding, went to the commission, and asked for a rehearing on that point. The statement was made by those gentlemen, "We are not seeking to apply these rules indiscriminately to existing construction; we do not intend to force, as you gentlemen say, the expenditure of millions of dollars in rearranging all existing circuits to conform with these rules that have been adopted for future construction; but we do say this—and this is the fundamental point—wherever there is a condition of disturbance to communication circuits for which the communication company is not responsible, on appeal to this commission we will act as though it was new construction; in other words, we will adopt the principle of this report, which is to prevent interference between power and communication circuits; and when the situation is bad enough to warrant a remedy, we will apply that remedy to existing conditions. Not of our own volition will we go into this thing; nor will we go through the country seeking places to oppress the power men and make them re-arrange their circuits; but when the appeal is made to us in a specific and definite case, we will act."

Now will somebody in this audience tell me where is the injustice in that? Will somebody in this audience tell me where there is oppression in that? What was the object of this investigation? It was to develop the facts, and to permit the communication interests and the power interests to work side by side, each in its particular field to perform the public function for which it is designed.

The committee has been criticized because it left the determination of certain things, such as transpositions, mutual arrangement of circuits, and so forth, to the telephone company. The telephone company may specify the transposition points, not more than so many per mile. It may require certain things to be done. Under certain conditions it may waive certain requirements. That, the gentleman from Utah said, was the open door through which the telephone company could enter into this controversy and depart at will, leaving the power company helpless. Now what was the reason the committee did that? Will any power man present tell me where he has in his employ an engineer capable—I use the word advisedly—capable of designing mutual transpositions between the communication circuits and the power circuits?

If anything is to be waived, is it against the power company or for it? Does the power company gain or lose by the waiver? It gains every time. The telephone company waives what? Something which would make the power company spend money.

We have been accused of legislating against certain forms of switch. I want to say to those gentlemen before they take this floor, that, as was expressed yesterday in most terse form by a man on the floor in a meeting of the committee, we are not legislating against any switch. We are legislating against certain effects of switching. If your air switch does not produce those effects we do not care how many air switches you use. Let it produce one transient disturbance in a communication line, it becomes objectionable, not because it is an air switch, but because it is producing disturbances. There is nothing else to it. No amount of talk can change that principle; nor can anything be found in the rules to controvert it.

**A. J. Bowie:** I am in accord with the purpose of the investigation of the interference of power lines with telephone lines and I recognize the great value of such an investigation. The report clearly shows that the fundamental cause of the difficulty is due solely to the parallelism of the lines. The natural remedy for this condition of course is to avoid parallelism. Means for avoiding disturbances other than correcting the fundamental cause are merely palliative measures and are in no way a cure for the troubles.

However, there is one section of the report which is not based on the research which characterizes the balance of the work. I refer to the sections dealing with switches and switching, namely sections 2-H, 2-I and 2-J. These sections come out very plainly with definite statements on the subject, advising prohibition of the use of air switches for operation under load, and positively requiring the use of oil switches. Such a positive recommendation would surely imply that the subject had received thorough investigation and I feel sure you will agree that before recommendations of such a sweeping character are enforced, they should be based upon most thorough and complete data. The report contains a definite statement to the effect that experimental data or tests were not available upon which to base the conclusion on the subject of switches ond the sole basis for these conclusions is what is stated in the report to be a commonly recognized fact that air switches produce more severe disturbances than oil switches. This is not a commonly recognized fact and I strongly take issue with the committee on that point.

Considerable information which the committee did not possess has proven that oil switches produce a more severe rise of pressure than air switches. In this connection, I am pleased to refer you to the September number of the General Electric Review, which contains an article by Mr. W. P. Hammond, describing an extensive series of tests on air and oil switches, wherein the tests were made to show the relative effect on the voltage surge on opening circuits. In one series of tests, a needle point spark gap was connected between two of the phases and the maximum sparking distance for both air and oil switches under the same load conditions. These tests proved that the maximum sparking distance was greater with oil than with air switches. Oscillograph records obtained did not indicate any material oscillation set up by air break switches. The article states in conclusion that the surges and voltages set up by the air break switches are not so violent as those set up by the oil switch. The further conclusion was arrived at that the air break switch will doubtless replace the oil switch for many uses.

In the development of high tension switching, the air and the oil switch each plays an important part. Each type has certain advantages and disadvantages for different conditions, but it is certain that the state of the art is such that absolutely no positive statements should be made which would eliminate from practical consideration the use of either type of switch. Therefore, I feel that you will agree that the report discriminates unfairly and without any foundation in fact against air switches and that the order of the commission based on the sections of the report dealing with switches should be repealed.

(To be continued.)

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### Tube Wire

Great interest exists in electrical circles as to what action the National Board of Fire Underwriters will take regarding the new concentric system of wiring, whose practical details were summarized in this journal last week. Before this economical method can be adapted from German to American practice it must be approved by the underwriters at their annual meeting in March.

Their favorable action would have a greater influence in increasing current consumption than is usually understood. Many small consumers are deterred from using electric current for lighting their homes because of its high cost. The initial cost of installation is particularly and necessarily high, and any factor which will reduce it will be of material aid in inducing the poorer man "to do it electrically."

Such a factor has been found in an insulated wire encased in a thin metal covering which acts not only as a protector but also as a return circuit in grounded systems. This wire was invented several years ago in Germany by a Mr. Kuhlo, whose name one manufacturer adopted to designate the wire. Other manufacturers called it "Rohrdadt," or tube wire, while in this country it is more generally known as concentric wire.

The wire is installed either by concealing it in the walls and ceiling or by fastening it onto their surface. The cost of the material is naturally much less than approved American equipment and the labor cost is also reduced, one wireman having set as much as 600 feet in a day. The ratio of the cost of labor to the cost of material, however, is greater than with the present systems.

While the immediate effect of its adoption would be to somewhat upset the supply and contracting business, conditions would soon adjust themselves as its uses and limitations are determined.

While it is impossible to prophesy the underwriters' decision their past action on similar questions would seem to indicate that it might be unfavorable. The board has always been suspicious of the fire hazard of any such system until it has been definitely proved to be safe. The burden of the proof rests upon the manufacturers. While the admitted increase in the number of fires of electrical origin is largely due to the correspondingly greater increase in the number of electrical installations, there yet remains abundant cause for safeguarding the use of electric current.

The American rules are much stricter than those of other countries. The factors of safety are larger and the specifications more severe. These requirements are to a large extent independent of the type of building construction, the wiring precautions in a Class A building being but little different from those in more inflammable types. This policy of safety first has been characteristic of the underwriters and a strong incentive will be necessary to cause them to reverse it in this case.

This statement does not mean that tube wiring is dangerous, for its safeness has been definitely proven in Germany. It merely means that higher standards for fire risk have been set in this country.

While they do not question the wisdom of caution, progressive electrical men are fully aware of the

opportunity to introduce electricity into the most humble home which this new method affords. That yesterday's luxury become today's necessity is only possible by bringing the price within the reach of all. To make electricity the cheapest, as well as the best, source of lighting, its cost must be reduced. If it were possible to approve this new form of wiring as a substitute for molding construction for 600 watt installations, no wires being concealed, the entire electric industry would be greatly stimulated.

---

**The Coming of the Lumen**

There is every present indication that the wattage rating of incandescent lamps will soon be as little used as the once popular candle power rating. Just as the twenty-five watt lamp has displaced the sixteen candle power lamp in the parlance of the day, so does the lumen bid fair to be the future standard rating.

The lumen is the unit of light flux, as distinguished from the candle power, which is the unit of light intensity—"the intensity which produces unit flux density at unit distance from the light source and thus produces a total flux of light equal to $4\pi$ units (the surface of the sphere at unit distance from the light source.") This means that instead of measuring the amount of light radiated in a certain specified direction, such as the mean horizontal candlepower, the total amount of radiation is measured and evaluated according to its capacity to produce the sensation of light.

The selection of a proper standard for light measurement has been difficult. Light is a physiological sensation produced by a physical radiation. To those who have no sight there is no light. But the human equation is so variable that a definite standard of sight is not possible and so arbitrary units of light measurement are now in general use.

The inadequacy of these empirical ratings has long been realized by scientific men, but the mere inertia of the older nomenclature has been sufficient to retain it long after it has outlived its usefulness. The force of progress, however, is strong enough to overcome the most inert conservative. Recent strides in means of efficient light production demand that methods of measurement catch up with the procession.

Careful investigation has shown that reliable photometric measurements of the new high-efficiency gas filled lamps can only be expressed in terms of lumens. In a recent paper before the Illuminating Engineering Society, Mr. Clayton H. Sharp has shown that the old photometric methods did not give constant results for the new type of lamp, there being a disturbing flicker and as much as 15 per cent variation in readings due to the rotation of the lamp while measuring its mean horizontal candlepower. As this difficulty can be obviated by measuring the total luminous output in terms of lumens, as is now the general practice in arc lamp photometry, it seems probable that the more scientific term will also be adopted as a standard for all electric lamps.

Such a change should cause but little confusion. On 110 volt circuits, 25 watt lamps would be known as 210 lumen lamps, and 40 watt as 336 lumen. The rating cited is based upon the present efficiency of the Mazda lamps specified. With higher efficiencies the lumen output is correspondingly increased.

The lumen has so much to recommend it as a rational unit of light measurement that its early adoption as a universal means for designating lamps is something greatly to be desired. If some such unit could have been used by the central stations in billing their lighting consumers much of the present misunderstanding about the necessary diffenence in rates for light and power might have been obviated. Many a man would be satisfied to pay one cent for 1200 lumen hours when he objects to paying seven cents per kilowatt hour, though the amount involved in each case is the same. Incidentally such a scheme might be of material assistance in turning the difficult corner which will arise when the new high efficiency lamps become available in smaller sizes for 110 volt circuits.

Separate meters are usually installed for lighting and power or heating circuits. If the lighting meter were graduated to read in lumen hours and the power meter in kilowatt hours the consumer would soon become accustomed to the change and the power company would be rid of one frequent cause for complaint.

While there is not much likelihood that this suggested plan will be applied, there is little doubt but what the lumen will be used for all lamp ratings in the near future. It consequently behooves every electrical man to become familiar with the term and be ready to explain it when it is applied.

---

**Helping Ourselves by Helping Others**

One advantage of slack business conditions is the chance afforded to finish some long-cherished plan. Opportunity is offered to perfect a design, to patent an idea or to write a paper which will materialize past thoughts. A thought has value as it is expressed and is lost if repressed. The more permanent the mode of expression the greater the value.

Every man has ideas which are worthy of lasting record. In the electrical industry they may be ideas for improving the design of apparatus or for increasing the efficiency of operation, they may be plans for increasing the use of current and of current-consuming devices, or they may be ideals for bringing about better relations between the public utility and the public served. All these thoughts are needed to improve the industry.

As a means for conserving these ideas and passing them on to greater uses the technical magazine freely offers its services. In this respect it belongs to its readers and the more freely its columns are used the more real becomes the ownership. This journal invites contributions from its readers and welcomes any expression of thought, whether in praise or condemnation.

The writer of a paper gains far more than he realizes. One of the surest ways of finding out how little you know about a subject is to write about it. Writing compels knowledge and teaches the writer for more than it teaches others. But above all. each of us owes a debt to all of us, past and present, for most of the knowledge we have, and the only way we can pay that debt is to contribute our findings to the common collection of experiences.

# PERSONALS

**F. C. Finkle,** consulting engineer, has returned to Los Angeles from a brief trip to Northern California.

**W. S. Heger Jr.** of the San Francisco office of the Busch-Sulzer Bros. Diesel Engine Company, is in Arizona.

**C. A. Hunt** of the Hunt Electric Company, Santa Cruz, spent several days during the past week at San Francisco.

**Hal Lauritzen,** Pacific Coast manager for the Holophane Works of the General Electric Company, is at Los Angeles.

**F. D. Fagan** of the General Electric Company, San Francisco, arrived the first of the week from a business trip to Portland and Seattle.

**H. C. McCutcheon,** in charge of the Los Angeles office of R. D. Holabird Company, has returned home after a week's stay at San Francisco.

**Geo. A. Gray,** Pacific Coast representative at San Francisco of Crouse, Hinds Company, is making a business trip through Southern California.

**G. I. Kinney** of the General Electric Company, San Francisco, has been appointed manager of the company's entire exhibit at the Panama-Pacific International Exposition.

**R. M. Alvord,** manager of the supply department, General Electric Company, San Francisco, left during the week for an extended business trip through Southern California.

**H. V. Carter,** president Pacific States Electric Company, San Francisco, is spending some days in Los Angeles and San Diego, the seat of the Panama-California Exposition.

**W. M. Hamilton,** Salem (Oregon) manager for the Portland Railway, Light & Power Company, was recently made chairman of the board of governors of the Salem Commercial Club.

**W. P. Naser** has been appointed manager of the San Francisco branch of the Trumbull Electric Company of Plainsville, Conn. Mr. Naser's headquarters will be at 595 Mission street.

**A. V. Olson,** assistant manager Electric Railway and Manufacturers' Supply Company, San Francisco, returned during the week after a several days' trip to Fresno, Cal., and surrounding territory.

**J. A. Vandegrift,** manager of the Oakland Lamp Works of the General Electric Company, is at present making an extended business trip to Portland, Seattle, and through the Northwest generally.

**A. B. Bond,** formerly of the Mazda Bureau of the General Electric Company, San Francisco, has been placed in charge of that company's Mazda exhibit at the Panama-Pacific International Exposition.

**C. B. Cooper,** chief operator of the Marconi Wireless Telegraph Company, Seattle, has been appointed superintendent of radio services of the Kilbourne & Clark Manufacturing Company of Seattle.

**C. E. Gilmer,** after a legal battle lasting two years, has won back his position as superintendent of outside construction for the Seattle lighting department, the Supreme Court recently deciding in his favor.

**Clyde B. Aitchison,** Oregon Railway Commissioner, has returned to Salem from Baker, Ore., where he collected data bearing on the rate case of the Eastern Oregon Light & Power Company, and on the proposed municipal lighting plant.

**T. C. Martin,** executive secretary of the National Electric Light Association, and **Geo. Elliott,** master of transportation, are expected to arrive in San Francisco January 18th, to confer with the general convention's committee about the national convention to be held at San Francisco in June.

**O. D. Street,** assistant general sales manager of the various distributing houses of the Western Electric Company, with headquarters at New York City, is making a business trip through Pacific Coast territory. He is expected arrive in Los Angeles during the week, at which point **F. H. Leggett,** Pacific District manager of the company, will meet and accompany him north to San Francisco, en route to Portland and Seattle.

**A. E. Beck** has resigned as permanent counsel for the British Columbia Electric Railway Company at Vancouver to resume private practice of law. Mr. Beck had been with the company for seven years and was a prominent member of the Pacific Coast Claim Agents' Association. A cabinet of silver ware was presented to him by the officials of the company when he formally severed his connection on January 1.

**E. W. Newcomb** has been appointed representative of the primary battery department, Thos. A. Edison Company, San Francisco, succeeding **P. B. Hyde,** who left last week to assume the duties of his new position with the company at Orange, N. J. Mr. Newcomb was formerly with the signal department of the Southern Pacific Company at Oakland, Cal. More recently, however, he was construction foreman of signals on the Salt Lake division of the O. S. L. and left the position of signal engineer of that company to take up the new line.

## MEETING NOTICES.

### Los Angeles Section Electric Vehicle Association.

At the monthly meeting of the Los Angeles Section of the Electric Vehicle Association of America, W. F. Rath read a paper on "Exide Batteries in Electric Vehicles." The paper was discussed by R. H. Starrett, W. R. Guy, B. J. Martin and J. Harry Pieper. M. W. Harrison talked on the application of storage batteries to everything on wheels, provoking a lively and general discussion. Three new applications for associate membership were presented and S. L. Mitchell, secretary and general manager of the Automobile Club of Southern California, was elected an honorary member. J. O. Case, chairman of the garage committee, reported good results in an effort to have uniform rates for charging adopted by the garages. P. H. Ducker, superintendent of transportation for the Southern California Edison Company, read comparative tables of cost for operating four gas cars and four electric cars in his company's service, the electric cars proving more economical to operate. The next meeting will be held 8 p. m., February 3, at the Jonathan Club.

### Electrical Development and Jovian League.

An enthusiastic meeting of the Electrical Development and Jovian League was held at the Hof Brau, San Francisco, Wednesday noon, January 6. As this was the first meeting of the new year, President-elect Fred Leggett outlined his plans for the term to come. First among these was the assigning of the details of each meeting to a chairman of the day who would be responsible for the speakers and entertainment. Next was the appointment of a new committee known as the live wire committee, whose duty is to stimulate attendance. The effectiveness of their first effort was indicated by a gathering of 112 men. President Leggett also announced the various league committees, as has been previously reported in these columns, and then introduced Mr. Geo. C. Holberton, manager of the San Francisco Gas & Electric Company, as chairman of the day. After some fine singing by employees of the Pacific Gas & Electric Company, Mr. Holberton introduced George Drake Smith, representative of the General Electric Vehicle Company, who told of a new plan of "Selling Juice by the Mile," whereby the San Francisco Gas & Electric Company will furnish and maintain Exide batteries for electric trucks in service in San Francisco.

### The Jovian Electrical League of Southern California.

A well-attended luncheon of the League, held at Christopher's, Los Angeles, on January 6, was ably presided over

by N. W. Graham, who had prepared a most entertaining program. Following the customary introduction of guests and the reading of reports, Tribune Pieper announced that the League would interest itself in the selection by the various local civic societies, of a Southern California Carnival Queen. Splendid musical selections were rendered by Vera Stanley and Herr Van Berg, who were accompanied by Dick Alter. C. S. Walton gave a very entertaining three-minute talk on Ira J. Francis. A highly instructive lecture was then delivered by Walton J. Wood, the Public Defender of Los Angeles, a position created in that city, and one which is unique in the annals of criminal procedure. He stated that about one-half of the cases handled by the Superior Court are turned over to the Public Defender, instead of young and unscrupulous lawyers, who were formerly assigned by the court to the unfortunate defendants. By thus aiding these unfortunates in obtaining a fair trial and frequently securing probation and positions for them, rather than a prison term, considerable money is saved by the county. Vampires, in the form of the young lawyers, are thus eliminated and over-punishment prevented. The Defender, who works in perfect harmony with the District Attorney, handles about 800 cases per month. Civil cases are also handled and about three-quarters of all the labor or wage collection cases are adjusted out of court.

## NEWS OF CALIFORNIA RAILROAD COMMISSION.

The commission has rendered a decision authorizing the Roseville Telephone Company, of Roseville, Placer County, to issue 400 shares of capital stock of the par value of $10 per share.

The commission has issued an order extending to May 31, 1915, the time within which the Midland Counties Public Service Corporation may issue $275,000 of its first and refunding 6 per cent 40-year bonds, to be used in retiring a like amount of bonds of the Midland Counties Gas & Electric Company. The corporation is also granted a similar extension of time within which to issue $546,000 of the same bonds to be used in retiring a like amount of bonds of the Coalinga Water & Electric Company.

The commission has rendered a decision authorizing the Butte Valley Telephone Company, operating in Siskiyou County, to issue 22 shares of stock of the par value of $10 per share. The proceeds are to be used for the construction of a telephone line along the Moore-Richardson road, just outside of the city limits of Doris, Siskiyou County.

The commission rendered a decision holding that the Standard Oil Company, Associated Oil Company, Producers Transportation Company, Associated Pipe Line Company and General Pipe Line Company of California are common carriers and public utilities, and subject to the Public Utilities Act of the State of California. The commission finds that these companies are controlled by five interests, namely, Standard Oil Company, Associated Oil Company, Independent Oil Producers Agency, General Petroleum Company and Kern Trading & Oil Company, which together control 95 per cent of the entire oil production of the State. These pipe lines are held to be public utilities in the transportation of crude oil, petroleum or the products thereof by means of pipe lines from the San Joaquin Valley oil fields.

The commission has issued a supplemental order authorizing the Southern California Edison Company to issue $518,000 face value of its 5 per cent bonds at not less than 87½ per cent. The company proposes to use the proceeds from the sale of these bonds in retiring notes in the sum of $558,000.

The commission has rendered a decision authorizing the San Diego Consolidated Gas & Electric Company to renew three promissory notes totaling $55,000 held by H. M. Byllesby & Company and bearing interest at the rate of 7 per cent per annum.

## NEWS OF WASHINGTON PUBLIC SERVICE COMMISSION.

The commission has established a service department. It is the idea of the commission to carry out the law with reference to the inspection of service of the utilities in the different cities of the state.

The commission is seeking to have its power extended to the extent enjoyed by similar commissions in other states in the matter of certificates of convenience and necessity. The law which it seeks from the legislature will provide that no public service corporation shall begin the construction of a line or system, or an extension, without first obtaining from the commission a certificate that the present or future public convenience and necessity require, or will require, such construction.

The report of the commission shows 156 telephone companies in operation, seventy electrical companies supplying current for power and light, and twelve companies furnishing gas to consumers in this state. A total of 43 steam lines are transacting business in Washington, while 19 are electrically operated.

The Seattle council is taking steps toward directing the corporation counsel to bring action before the state public service commission against the Puget Sound Electric Railway, commonly known as the Tacoma Interurban, for lower fares within the city limits of Seattle, and against the Seattle, Renton & Southern Railway to prevent its charging of passengers who carry packages, in addition to the usual fares.

## COMMITTEES FOR 1915 CONTRACTORS' CONVENTION.

Arrangements are rapidly being perfected for the reception and entertainment of delegates to the annual convention of the National Electrical Contractors' Association which is to be held at San Francisco, July, 1915.

The following committees have been appointed:

**General**—W. S. Hanbridge, Chairman.

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| C. F. Butte | A. H. Brainager | H. M. Hope |
| A. L. Hughes | Geo. Sittman | H. C. Reid |
| W. D. Kohlwey | W. H. Kirsten | C. L. Chamblin |
| M. Fortini | L. R. Boynton | Lee Gilpin |
| | Geo. Smith | |

**Finance**—C. F. Butte, Chairman.

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| Geo. Brouillet | W. Gribbie | D. E. Harris |
| E. M. Cutting | F. Watts | |

**Reception and Dance**—W. D. Kohlwey, Chairman.

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| Jas. Barry | C. C. Hillis | W. Hooker |
| | Mr. St. John | |

**Boat Ride**—M. Fortini, Chairman.

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| W. W. Briggs | O. Orrick | R. D. Holabird |
| H. A. Sayles | M. Quinn | |

**Lunch on Boat Ride**—Geo. A. Sittman, Chairman.

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| H. H. Daly | Brewster Hall | W. Neiman |
| | M. L. Scobey | |

**Dinner-Dansant**—W. H. Kirsten, Chairman.

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| R. M. Alvord | Chas. Wiggin | Sam'l Taylor |
| W. L. Neelands | L. Levy | V. Kean |

**Auto Rides**—L. R. Boynton, Chairman.

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| R. Wolden | W. Hutton | F. Fowden |
| | W. L. Goodwin | |

**Open Meeting**—N. M. Hope, Chairman.

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| W. S. Berry | G. Holberton | C. V. Carter |
| C. E. Heise | P. Decker | |

**Reception**—H. C. Reid, Chairman.

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| C. Renstrom | A. E. Drendell | D. Gallivan |
| S. B. Gregory | C. J. Newberry | P. B. Hyde |
| | F. H. Poss | |

**Zone**—A. L. Hughes, Chairman.

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| H. E. Sanderson | F. Thall | H. H. Hoxie |
| C. C. Caven | J. T. Jarvis | |

**Exposition**—C. L. Chamblin, Chairman.

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| M. Steele | H. B. Squires | E. Dwyer |
| A. E. Rowe | W. Dixon | |

**Music**—Geo. Smith, Chairman.

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| A. Meinema | W. Thompson | B. Hansen |
| A. V. Olsen | G. Davis | |

**Oakland**—Lee Gilpin, Chairman.

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|---|---|---|
| C. Gilson | Geo. King | R. Gilson |
| B. Hill | E. Claussen | J. Genlser |
| | H. Kimball | |

**Press and Publicity**—W. S. Hanbridge, Chairman.

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|---|---|---|
| A. H. Halloran | J. Redpath | E. B. Strong |

**Decoration**—A. H. Brainager, Chairman.

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|---|---|---|
| W. W. Perry | C. Mitchell | H. Engle |
| O. Vitt | H. Hasselbach | |

## CALIFORNIA ASSOCIATION OF ELECTRICAL INSPECTORS

### Section of N. A. E. I.

C. W. Mitchell, President. Arthur Kempston.
Wm. G. Pennycook, Vice-Pres. B. C. Hill, Executive Comm.
John W. Carrell, Secretary-Treasurer, 814 Scott, San Francisco.

The purpose of this organization is to standardize the common practice in electrical construction with the National Code as the general standard.

Questions pertaining to electrical construction will be answered in these columns, but only from the point of view of the Code. This is a voluntary organization and the answers published under this heading must not be construed as authoritative, or binding. No attempt will be made to correllate the answer from the several Inspection Districts, as an occasional difference of opinion will tend to induce further study on subjects. All questions will be passed upon by an executive committee.

Address all communications to the secretary.

The California Association of Electrical Inspectors recently in regular session passed a resolution inviting the National Fire Protection Association to abridge and reassemble the rules pertaining to wiring of buildings in one group.

They also submitted an example of such abridgement and list of rules involved. The effect of this abridgement would be to reduce the size of the Code by fifty per cent.

#### Example of Abridgement.

**Metallic Armor Systems:**

(Rigid and flexible conduit, armored cable and metal moulding).

(a) Must be continuous from outlet to outlet, to junction boxes or cabinets; must properly enter and be secured to all fittings, and entire system must be mechanically secured in position.

(b) Must, for service connections or main feeder circuits, be run continuously into main cabinet or gutter surrounding panel board, as the case may be.

(c) Must be equipped at every outlet with an approved outlet box or plate. Outlet plates must not be used where practicable to install outlet boxes.

At exposed ends of metallic armor where wires pass from system without joint, tap or splice (but not at fixture outlets), approved fitting having separately bushed holes for each conductor must be provided.

In buildings already constructed where conditions are such that neither outlet box nor plate can be installed, these appliances may be omitted, providing the metallic armor ends are bushed and secured.

Departure from this rule may be authorized by special permission.

(d) Must, where entering junction boxes, cabinets and at all other outlets, etc., be provided with approved bushings or fastening plates fitted to protect wire from abrasion or by means of other devices specially designed and approved for the purpose.

(e) Junction boxes must always be installed so as to be accessible.

(f) For cabinets, junction boxes, outlet boxes or plates, installed for concealed work in non-fireproofing construction, front edges must not be more than one-fourth inch back of completed plaster surface and if this surface is broken or incomplete it shall be repaired so as to close all gaps or spaces about edges. For wooden surfaces the front edges must be flush with completed outer surface or may project therefrom.

(g) Wooden or composition cabinets must not be used with metallic armor systems.

(h) Must have metallic armor permanently and effectually grounded to water piping, gas piping or other suitable grounds provided that when connections are made to gas piping, they must be on the street side of the meter. If the metallic armor system consists of several separate sections, the sections must be bonded to each other, and the system grounded, or each section may be separately grounded, as required above. Where short sections of metallic armor (or pipe of equivalent strength) are used for the protection of exposed wiring on side walls, and such metallic armor or pipe and wiring is installed as required by No. 26 e, the metallic armor or pipe need not be grounded.

Metallic armor and gas pipes must be securely fastened in outlet boxes, junction boxes and cabinets, so as to secure good electrical connections.

If metallic armor, couplings, outlet boxes, junction boxes, cabinets or fittings, having protective coating of non-conducting material such as enamel are used, such coating must be thoroughly removed from threads of both couplings and metallic armor, and such surfaces of boxes, cabinets and fittings where the metallic armor or ground clamp is secured in order to obtain the requisite good connection. Grounded pipes must be cleaned of rust, scale, etc., at place of attachment of ground clamp.

Connections to grounded pipes and to metallic armor must be exposed to view or readily accessible, and must be made by means of approved ground clamps to which the ground wires must be soldered.

Ground wires must be of copper, at least No. 10 B. & S. gage (where largest wire contained in metallic armor is not greater than No. O. B. & S. gage), and need not be greater than No. 4 B. & S. gage (where largest wire contained in metallic armor is greater than No. O. B. & S. gauge). They shall be protected from mechanical injury.

The ground on the metallic armor system is not to be considered as ground for a secondary system. (See No. 15).

(i) Must, for alternating current systems, have the two or more wires of the same system enclosed in one metallic armor.

(j) All bends must be so made that metallic armor will not be injured.

For conduit, the radius of inner curve of any elbow must not be less than 3½ inches, and there must not be more than four quarter bends (or equivalent) from outlet to outlet, the bends at outlets not counted.

For armored cable, the radius of inner curve of any bend not to be less than 1½ inches.

(k) Armored cable, when installed in so-called fireproof buildings in course of construction or afterwards if exposed to moisture, or where it is exposed to the weather, or in damp places, such as breweries, stables, etc., must have a lead covering placed between the outer braid of the conductor and the steel armor.

The lead covering is not to be required when the cable is run against brick walls or laid in ordinary plaster walls unless same are continuously damp.

(l) Metal moulding where passing through a floor must be carried through an iron pipe extending from the ceiling below to a point five feet above the floor, which will serve as an additional mechanical protection and exclude the presence of moisture often prevalent in such locations.

Where the mechanical strength of the moulding itself is adequate, this ruling may be modified to require the protecting piping from the ceiling below to a point at least three inches above the flooring.

Where such mouldings pass through a partition the iron pipe required for passing through floors may be omitted and the moulding passed directly through, providing the partition is dry and the moulding is in a continuous length with no joint or coupling within the partition.

Backing for metal moulding must be secured in position by screws or bolts, the heads of which must be flush with the metal.

The N. E. Code rules involved are: Numbers 3, 4, 8, 12, 15, 16, 17, 18, 19, 23 to 39 inclusive, 42 and 43.

Numbers 12 and 15 are involved only in so far as they pertain to wiring of buildings.

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### TRADE NOTES.

Chas. C. Moore & Company have moved their San Francisco offices to commodious quarters in the Sheldon Building.

Bids will be opened January 19th by the Board of Public Works at Seattle for furnishing one boiler, engine, generator and switchboard for power house at the Tuberculosis Hospital and Sanitarium at Richmond Highlands.

The Cutler-Hammer Manufacturing Company, Milwaukee, had an interesting exhibit at the New York Automobile Show which opened January 2d. The principal device shown was the electric gear shift for gasoline automobiles which was mounted on a Winton transmission. The operation of this device, which eliminates the hand shifting of gears, is controlled by push bottons mounted in the center of the steering wheel. The Winton Six is one of the 1915 cars to be furnished with electric gear shift. C-H single button push-and-pull automobile lighting switches are shown in various combinations for the control and dimming of automobile lights. Cutler-Hammer Pyroplax fireproof insulating material is also shown and samples of such parts as radiator caps, switch sub-bases, fuse boxes, motor terminal blocks, etc., are mounted on a display board. A similar exhibit will be made at the coming Chicago automobile show.

# NEWS NOTES

## INCORPORATIONS.

SAN FRANCISCO, CAL.—Sacramento Valley Telephone Company, $500,000, shares $100 each, subscribed $2500, by J. R. Edwards, J. F. Cambbell and F. Lukenbell.

POCATELLO, IDAHO.—The Gate City Electric Supply Company has been organized with a capital stock of $10,000. D. M. Griffin of Salt Lake City being president.

BAKER, ORE.—G. W. South, F. A. Phillips et al., of Medical Springs, have formed the Medical Springs Telephone Company, which proposes to build a telephone line to connect that section with the county seat.

VANCOUVER, WASH.—Portland-Vancouver & Northern Railway Company has filed articles of incorporation. The head offices will be here. Henry Crass, mayor of this city, is president. The object is to connect Portland and Vancouver by an electric line.

PORTLAND, ORE.—The Oswego Lake Water, Light & Power Company has filed articles of incorporation. The purpose of the company is to furnish water to the city of Oswego and to install a power plant. It is incorporated by A. S. Pattullo, Frederick H. Strong and Isaac D. Hunt, all of Portland, and is capitalized at $5000.

## ILLUMINATION.

PACIFIC GROVE, CAL.—This city in a very short time will have an entirely new street lighting system.

FORT BRAGG, CAL.—H. F. Milliken has announced his intention of applying for a franchise for a gas plant.

BUENA PARK, CAL.—The Southern Counties Gas Company expects to make an entrance to this city in the near future.

SANTA ANA, CAL.—The council has decided to enter a new contract with the Southern California Edison Company for street lighting.

FULLERTON, CAL.—The board of supervisors has granted to the Southern Counties Gas Company a franchise to lay pipes for gas in certain sections of Orange county.

LOS ANGELES, CAL.—Bids are being taken for furnishing electricity and installing lights in the Norwalk Lighting District, in accordance with specfications on file with the board of supervisors.

HONOLULU, T. H.—Substantial improvements to the electric light service and police and fire alarm system are planned, all to be installed if possible before the end of 1915. The cost of the street lighting system is estimated at $18,000.

PHOENIX, ARIZ.—Manager Farish and City Electrician Dodge have completed plans for an extension of the ornamental street lighting system. It has been decided to extend the Central avenue system north and south to the city limits.

DALLAS, ORE.—This city is about to enter into a contract with the Oregon Power Company to light its streets with 100 candlepower incandescent lights for a period of five years at $22 per light per year. About 90 lamps will be required.

ANAHEIM, CAL.—The city has entered into a contract with W. H. Houts, providing for 59 five light ornamental posts to be installed on Center street from Clementina to Philadelphia, and on Los Angeles street from Broadway to Cypress, work to begin at once.

SAN FRANCISCO, CAL.—A new system of street lighting has been ordered for Van Ness avenue by the supervisors. Two high candle power tungsten lamps on each trolley pole is the order to the Pacific Gas & Electric Company and there are eight trolley poles in each of the 31 blocks between Market street and the bay.

## TRANSMISSION.

ASHLAND, ORE.—The subst... the Oregon-California Light & Power Company ... by fire. The loss is estimated at $15,000.

AUBURN, CAL.—The Bell Electric Company is to build a new power line three miles long to furnish power to the farms in Shirland Tract & Long Valley. The line will start in Auburn.

TULARE, CAL.—A contract for installing the conduit and cable for the electrolier system was let by the council to E. F. McEwin of Ocean Park for $4300. The system when completed will light 17 blocks.

VENTURA, CAL.—The board of supervisors has granted the Pacific Light & Power Corporation a franchise to furnish light and power to the Simi Valley, the Las Posas and Camarillo sections and nearly to Saticoy.

ENUMCLAW, WASH.—The Puget Sound Traction, Light & Power Company has secured an option on the power plant here and will extend the service to Wilkeson, Carbonado, Burnett and other points in that direction.

NORTH YAKIMA, WASH.—The Pacific Power & Light Company has made application to the board of commissioners of Yakima county for a 50 year franchise granting the right to operate transmission lines in the town of Selah.

EL PASO, TEX.—The Eighty-five Mining Company, operating in the Lordsburg District, will install an electrical hoist at the plant in the near future. An electric generating plant is being installed on the Jim Crow Mine in the Stepple Rock District.

GRANTS PASS, ORE.—The Rogue River Public Service Corporation expects to have two more 400 h.p. turbines in operation at its Gold Hill plant by February 1, giving a total capacity of 1200 h.p. F. W. Dodge is engineer and manager at Gold Hill and G. W. Sorenson secretary at Grants Pass.

SEATTLE, WASH.—The Puget Sound Traction, Light & Power Company has consummated the purchase of 3000 acres of land in Skagit county, together with water rights on Baker River. This step has been pending for a long time as a part of the plan of Stone & Webster to develop electric energy at low cost for manufacturing purposes.

VANCOUVER, B. C.—The British Columbia Electric Railway spent almost a million dollars in making extensions and improvements during 1914. In October of last year its third unit on the Jordan River was completed. The company constructed one of the largest concrete dams in the world for gathering the waters of the Jordan River. The cost of this structure alone was $565,000.

SILVER CITY, N. M.—State Engineer James A. French has granted the Socorro Mining & Milling Company an extension until January 25th for the completion of its power plant at Mogollon. The power plant will generate 1000 h.p., which will be used in operating the company's mine and mills and other mines and mills in the district. Current for lighting will be transmitted to the town of Mogollon. Water of the Whitewater creek is to be utilized.

## TRANSPORTATION.

PORTLAND, ORE.—The Portland & Oregon City Railway Company has accepted the franchise granted by the Milwaukie city council and has started to build its line through Milwaukie.

PORTLAND, ORE.—The city council of Portland has decided that the United Railways must pay to the city five per cent of its gross earnings each year for the privilege of handling freight cars over the city streets.

SAN F... CAL.—The operation of the United Railroads ca... ...fornia street between Sixth and Thirty-third avenues, ... ...week and the United Railroads began tearing up the old rails and ties to make room for the construction of the Municipal Railway line, which F. Rolandi is buildin... ...nder contract with the board of public ... ...ad, which will extend from Geary ... ...to California street and Thirty-... ...completed about March 1st.

SAN FRA...SCO, CAL.—The city engineer is to look over a new plan for surmounting the Church street hill, a plan brought in by Supervisor McCarthy, who said it had been drawn by a young engineer who figured that the work could be done for $65,000. For the purpose of bringing the city's rights to a decision, the board adopted a resolution of intention to extend the Stockton street line down Fourth street to Third and Townsend, taking over the use of the United Railroads' tracks on payment of one-half their cost.

## WATERWORKS.

SANTA MONICA, CAL.—The city council is planning for an adequate water supply.

LOS ANGELES, CAL.—John Carner has been granted a franchise to lay down and maintain for 40 years a system of water pipes along streets in the Mills & Wicks Subdivision.

PORT TOWNSEND, WASH.—City Engineer Sadler is working on plans for the changing of the Olympic Water System mains where they cross the Portage and bids will soon be c...ed.

PORTLAND, ORE.—Construction of the proposed 16 in. water main for the reinforcement of the water supply throughout Irvington and contiguous districts will be started immediately. It will cost about $50,000.

SAN DIEGO, CAL.—As a result of a resolution passed by the city council, City Attorney Cosgrove will go ahead at once with condemnation proceedings for the purchase by the city of Cuyamace Water Company's holdings.

SAN DIEGO, CAL.—Contractors have completed moving the old filter plant from Chollas to the Lower Otay reservoir and have begun the contruction of the new unit. Construction of the Bonita pipe line is being held back pending settlements for right of way.

BEAUMONT, CAL.—At a meeting of representatives of the water company and Messrs. Sewell, Thompson and Tillery, plans for acquiring the water system for the city were discussed and in all probability plans will be ready to submit to the public in the near future.

SAN DIEGO, CAL.—The city council has authorized the superintendent of finance to employ Hydraulic Engineers J. B. Lippincott and M. M. O'Shaughnessy, as experts to make a report upon the value of the Volcan water system, with a view of developing the system for city use.

ALBUQUERQUE, N. M.—Mayor Boatwright is shaping plans for a more adequate water supply for the city. City Engineer Gladding will make an estimate of erecting and operating a municipal plant. The water company will be asked to name the figure at which it will sell its plant to the city.

SANTA MONICA, CAL.—This city has made a second application to the Los Angeles water board for a supply of Owens River water. The State Railroad Commission will be asked to make an appraisement of properties so the city will have data upon which to calculate in event a bond issue is contemplated for a water system.

LAS VEGAS, NEV.—Newel K. Leavitt of this city has made application to the state engineer of Nevada to appropriate public waters. Such appropriation to be made from surface and underground waters by means of pumps and to be converted by means of pipes, irrigation ditches and flumes and used for irrigation and domestic purposes, the water not to be returned to stream.

SAN MATEO, CAL.—Trustees of the Leland Stanford Jr. University have decided to take over the active management of the Bear Gulch Water Company from the estate of late Senator Felton, and to develop the system until an abundance of water is assured to consumers in Palo Alto, Woodside, Menlo Park and vicinity.

LOS ANGELES, CAL.—The board of supervisors will receive bids up to February 8th for a franchise for a system of water pipes, in certain streets beginning at the intersection of Central and Slauson avenue, Hooper and Florence avenues and certain other streets. The franchise gives the right to distribute water to the adjacent territory for domestic and other uses.

LOS ANGELES, CAL.—The board of public service commissioners have been promised by the council that immediate action would be taken in regard to supplying the Hollywood District with municipal water. The principal point to be determined is whether money shall be raised through the creation of an assessment district or the issuance of bonds.

PHOENIX, ARIZ.—C. M. Shannon is promoting a project of a huge pumping proposition in the Casa Grande region. Within a mile of the famous Casa Grande ruins, 1400 acres are held by the company. On the main line of the Southern Pacific across the Gila and about 20 miles away, there will be erected a power plant, engines will be fed with tank fuel oil trains. A transmission line will carry electricity to the pumps.

PENDLETON, ORE.—W. R. Hinkle has just completed the survey of the reservoir in Alkali Canyon above Echo, and the feed canal to supply the reservoir. This work was done for the Western Land & Irrigation Company, and when built will supply the project with water for summer use. The plans will be presented to the state engineer for his approval in the near future. The construction of this system will entail an investment of about $250,000.

STANFORD UNIVERSITY, CAL.—In view of opening the peninsula foothill property of Stanford University for home sites, the University trustees are planning the construction of a dam below Searsville Lake to impound the flood waters of the San Francisquito Creek, which flows through the college holdings. Vanderlyn Stow, business manager of the university properties, has been given authority by the board of trustees to proceed with the plan.

SAN DIEGO, CAL.—It is probable that the electors of San Diego will vote on the proposition of purchasing the Volcan water system at the regular election to be held in April. The proposition carries with it the voting of $1,000,000 in bonds as first payment. The purchase price is to be $2,500,000 and an additional $1,500,000 to be expended by Henshaw in construction and not to be paid by the city until the expiration of 40 years, if so desired.

SAN FRANCISCO, CAL.—Mayor Rolph and the advisory water committee have decided on March 30 next as the date for the bond election for the purchase of the Spring Valley properties. It is proposed to submit to the people the question of the purchase of the Spring Valley properties for $34,500,000. This figure includes all of the water-bearing properties useful to this city. At this price the advisory water committee has stated that the property will pay for itself and is taken as one index that the figure of $34,500,000 is not excessive.

PORTLAND, ORE.—Engineer D. D. Clarke of the Water Bureau, in his annual report, recommends that steps be taken for the better protection of the Bull Run pipe lines near the Mount Hood power plant of the Portland Railway, Light & Power Company, where an immense flume of the latter company has broken several times. He says the flume should be constructed in a more substantial manner or removed to some other location. Preparations are being made for the construction of the new dam at the headworks.